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# United States Department of Agriculture,

## FOREST SERVICE.

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### INSTRUCTIONS TO FOREST OFFICERS IN RESERVE PLANTING.

The instructions contained in this circular are primarily for the use of forest officers in charge of rangers' nurseries. Their application should be limited to occasions when technical men are not present to give advice based on actual conditions. Since no hard and fast rules can be made for planting work of this kind, it will be necessary in all cases where the rules here given are employed for the officer in charge to use his own judgment in applying them.

#### NURSERY SITE.

(1) To insure daily attention and to avoid loss of time the ranger's nursery site should be located as near as possible to the headquarters buildings.

(2) Comparatively level ground should be chosen as a precaution against surface washing. A deep, moderately fertile, well-drained soil is best.

(3) If available, at least one-half acre should be set aside for the nursery. Of this, much the larger part will be required for transplant beds after the first or second year.

#### WATER SUPPLY.

(1) At high altitudes, and in other situations where the soil is naturally moist, the nursery will need but a small amount of water; in more arid situations, however, it will require frequent watering.

(2) The nursery should be located as near as possible to the water supply. If the water is secured from a stream or spring some distance away, it may be conducted to the nursery in an open ditch, board trough, or pipe. A pipe with hose connections is best, though the small seed beds can easily be watered with a sprinkling pot.

#### SEED BEDS.

(1) If a low system of shading is to be used the most convenient size for seed beds is 4 feet by 12 feet. If the lath-house system is employed the beds might well be larger. The width, however, should

never exceed 6 feet. In the beginning, four beds, 4 by 12 feet in size, should suffice, although the number may be increased or reduced to meet local needs. Paths 18 inches to 2 feet wide should separate the beds.

(2) The ground for the seed beds should be plowed or spaded thoroughly before seed is planted in the fall or early spring. All roots, sticks, stones, etc., should be removed.

(3) To insure drainage the beds should be raised from 2 to 3 inches above the bottom of the paths. The soil should be well pulverized and the surface should be smooth and moist when the seed is planted.

#### SEED SOWING.

(1) The seed may be sown either in shallow drills or broadcast. Sowing in drills is usually best, since the seedlings can be cultivated more easily.

(2) The drills should be 6 inches apart, and should run across the beds. They may be made by dragging a sharpened stick along one side of a 6-inch board. A still more rapid method is to nail triangular strips the desired distance apart on the underside of a board, and to mark the drills by pressing the board down on the bed.

(3) Unless the soil is free from weeds, broadcast sowing is not advisable. Some species, however, do remarkably well when sown broadcast, and it would be well to plant a few square feet of some of the beds experimentally in this manner.

(4) Sowing should ordinarily be done in the spring, about the time early garden seed would be planted. The exact time will depend upon the location and the season. If done too early, while the ground is still cold and wet, germination will be slow and many of the seeds will rot.

(5) Seed should be very carefully covered, for if not enough cover is given them they may wash out, and if too much, they may either rot or lie over until another season. A safe rule is to cover small seeds to a depth of about twice or three times their diameter. The usual tendency is to plant too deep. Firming the beds with a board will prevent the soil from washing when sprinkled.

(6) Immediately after planting it is an excellent practice to cover the beds with a very thin mulch of clean leaves, moss, or needles. This keeps the surface moist and hastens germination. Water in limited quantities should be applied even to mulched beds. The mulch should be thin and light enough to allow the seedlings to break through the surface. If too heavy it should be removed when the seedlings begin to come up.



## QUANTITY OF SEED REQUIRED.

(1) The quantity of seed required per unit of seed bed will depend upon the number of seed per pound and the percentage of germination.

(2) Overcrowding produces poorly developed plants. The seed should be sown so that the seedlings will not require thinning, since the plants removed rarely can be saved by transplanting.

(3) Seed of low germination per cent should be sown thickly. The seeds of this class which will be used in rangers' nurseries are the firs, larches, and cedars.

(4) Species with a higher germination per cent, such as the pines and the spruces, should be sown so that each seed will alternate with an open space approximately equal to its width.

## SHADE.

(1) In practically all situations conifers require partial shade for the first year. In nurseries this must be supplied artificially by covering the seed beds with screens of lath, shakes, or brush.

(2) The most convenient screen is a 4 by 12 foot rectangular frame constructed of 2 by 2 inch strips, with lath nailed crosswise, so that each lath alternates with an opening equal to its width.<sup>a</sup>

(3) A more substantial frame can be constructed of strips of the same dimension, but with a center crosspiece and a diagonal brace between the end and center crosspieces. Twelve-foot strips, three-eighths inch thick by 2 inches wide, may be substituted for lath, and nailed lengthwise of the frame.

(4) Where lumber is not available, slender saplings of aspen or pine split in the center can be used for the side strips, with split shakes as substitutes for laths. Even brush may be used for a temporary shade.

(5) The shade frames, whatever their character, should be supported on stakes 18 to 24 inches above the surface of the beds and set about 3 feet from each end of the frame. A crosspiece of inch material should connect the stakes on opposite sides of the bed. The frames may be hinged to posts, which permits their being raised and lowered.

(6) In semiarid regions, or where material is cheap and plentiful, a lath house is the best method of shading. One can be constructed by setting posts about 12 feet apart, and connecting them at the top with 2 by 4 inch stringers, and covering the entire structure with lath, or woven-lath fencing. When lath or woven fencing can not be secured readily, brush or light poles can be spread over the framework until half shade is produced. The top of the frame should be about 7 feet above the ground.

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<sup>a</sup> See fig. 59, p. 190 of Yearbook Extract 376, "How to grow young trees for forest planting."

## CARE OF SEEDLINGS.

## DISEASES AND INJURIES.

All conifers, and some broadleaf species, while in the seed beds are subject to "damping off."<sup>a</sup> This disease is very prevalent and often destroys a large per cent of the seedlings. It is caused by a fungus which attacks the young plants near the surface of the ground, causing them to wilt and die.

To prevent or check this disease, if it should become prevalent, it is necessary to adhere closely to the rules for regulating shade, watering, cultivating, etc. Dry sand, charcoal, or fine gravel spread on the beds will often check the trouble.

## WATERING.

The proper application of water to the seed beds before and after germination is particularly important. The following rules should govern the watering, making due allowance for local factors, such as altitude, local showers, etc.:

(1) The soil should be kept uniformly moist through the germination period. From the time the seed is sown until the seedlings are a week or ten days old, water should be applied frequently, though not excessively, since excessive watering will cause "damping off."

(2) After the seedlings have been up for ten days or two weeks, water should be applied less frequently, though the soil should never be dry enough to powder when dug up with the fingers.

(3) The soil should be thoroughly wet to a good depth at each watering, since one proper application of water is far more beneficial than a dozen improper ones. Water should be applied with a sprinkling pot or hose nozzle. Irrigation by flooding or by running water through ditches or paths is usually not advisable, and if practiced great care should be taken not to keep the ground too wet.

(4) Watering should be done early in the morning or late in the afternoon. Under no circumstances should water be applied during the middle of the day, unless it is cloudy and there is prospect for continued cloudiness throughout the day.

## REGULATING SHADE.

(1) Shade frames should be allowed to remain over the seed beds at all times except during damp, cloudy days following rain.

(2) In localities where heavy rains are followed by high temperature, the frames should be raised or removed as soon as the sunshine disappears from the seed beds, and kept so until the sun appears the following morning. This should not be neglected, since proper drying and airing of the soil after rain checks "damping off." If water has been applied excessively the instructions just given for drying out the soil should be followed.

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<sup>a</sup> For a complete discussion of this disease, see p. 49, Bul. 29, "The Forest Nursery."



(3) With the high shade-frame system, it is occasionally necessary to remove part or all of the lath inclosure from the beds to admit free circulation of air. This is necessary, however, only under exceptional circumstances.

#### CULTIVATING AND WEEDING.

(1) Seedlings should be cultivated often, in order to subdue weeds, stimulate growth, and keep the soil in good condition. Cultivation should be shallow and should pulverize the soil thoroughly.

(2) Cultivation should be given after rains, or when the soil shows signs of baking or drying. This can be done either with a narrow hoe or with a small rake made of nails. An onion hoe is good for the purpose.

(3) When "damping off" occurs, the soil should be stirred frequently to hasten surface drying. If this precaution and that of removing the shade frames is taken, a serious attack of "damping off" can often be arrested.

(4) Weeds should never be permitted to grow in the seed beds. Failure to remove weeds will seriously impair the vigor of the seedlings. Weeds that are not destroyed by cultivating should be pulled up and not cut off with a hoe.

#### MULCHING.

(1) Where the winters are severe it is advisable to mulch the seed beds to protect the seedlings from injury by cold drying winds, as well as to keep the ground from heaving in the spring. Where snow remains on the ground all winter, mulching is unnecessary.

(2) Any substance such as leaves, straw, or moss which is free from weed seed will serve as a mulch. A layer from 3 to 4 inches deep is sufficient. The mulch can be held in place by laying sticks or strips of boards across the beds between the rows. It should be removed at the beginning of the growing season, else the seedlings will be retarded and weakened.

#### TRANSPLANTING.<sup>a</sup>

(1) Practically all evergreen seedlings should be transplanted to open nursery rows when one or two years old.

(2) Transplanting should be done in the spring when the soil is in good workable condition, but before new growth begins.

(3) The area used for transplants should be near the seed beds and on good soil. It should be prepared as thoroughly as for a garden.

(4) A convenient width for transplant beds is 6 feet, with any convenient length. They should be elevated, but only slightly, since beds which are too high dry out rapidly.

(5) The rows should be 8 inches apart, and should run across the beds. The seedlings should be set from 2 to 4 inches apart in the rows, the exact distance depending upon the size of the plants.

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<sup>a</sup> See Bul. 29, "The Forest Nursery;" also Circular 61.

(6) In transplanting, great care should be taken not to allow the roots of the seedlings to become dry, since even a short exposure to sun or air will be fatal. They can best be carried roots downward in a pail containing 4 or 5 inches of water.<sup>a</sup>

#### FIELD PLANTING.

(1) After the seedlings have remained in the transplant beds one or two years they should be taken up and planted on permanent sites. This process is termed field planting.

(2) To properly choose a planting site the soil and moisture requirements of the species to be planted must be fairly well understood. The native species should be planted on situations similar to, or adjacent to, those on which they are found growing naturally. If species not native to the region are used, some knowledge of their silvical characteristics is necessary to choose a situation to which they are adapted.

(3) Field planting should usually be done in the spring, just before the growth begins. In regions like California, where there is a rainy and a dry season, planting should be done during the rainy season, as soon as the soil is sufficiently wet to furnish the necessary moisture.

(4) In field planting the same care as in nursery transplanting should be taken to prevent exposure of the seedlings. To protect the roots from exposure, the seedlings should always be carried, root downward, in a pail partly filled with water.

(5) The method of planting depends upon the character of the soil. The most satisfactory method is to plant the seedlings in holes dug with a mattock. Usually two men can work together to the best advantage, one going ahead and digging the holes, the other following and setting the trees.<sup>a</sup>

(6) To exclude air from the roots of newly planted trees, and to bring the soil in close contact with them, the surrounding earth should be firmly packed. It is absolutely necessary for success that this rule be followed strictly.

(7) Trees may be planted 4 by 4, 5 by 5, or 6 by 6 feet apart. In most cases the latter spacing will be found best. The roughness of planting sites will often prevent regular spacing, but effort should be made to conform to a system.

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<sup>a</sup> See Circular 61.





